Title: HOME COFFEE ROASTER

Abstract: Home coffee roaster insertable into common or microwave based home oven has an open roasting pan in which coffee beans are heated. The open roasting pan provides a user to visually inspect the color of the roasting coffee beans. The roasting pan is releasably attached to the body of the home coffee roaster by means of a snapping device thereby quick release of the roasting pan off the roaster's body is provided. The roasting pan has a substantially low thermal mass providing for both heating and cooling at a relatively high rate whereby the heating profile of the roasting bean is controllable by the user. A pneumatic, hydraulic and/or electrically based rotating mechanism for evenly spreading and swirling the coffee beans while heated are provided.
HOME COFFEE ROASTER

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of priority from an application for a provisional patent numbered 60/885631 filed in the US on 19 January 2007.

FIELD OF THE INVENTION

The present invention relates in general to systems for coffee roasting. More particularly the present invention relates to a device installable in a common, or microwave based, home oven providing for roasting coffee beans.

BACKGROUND OF THE INVENTION

Systems and methods for roasting coffee beans at home are known. Exemplary is a special purpose roasting device providing for roasting a relatively small amount of beans disclosed in US patent 6942887. This device has a roasting chamber heated by an integral electric heater. Air is intermittently blown through the roasting chamber at a relatively low flowing rate during the heating of the coffee beans. A built in filter provides for removing smoke and steam generated by the heated beans. A portion of the surface of the roasting chamber is transparent providing for visually inspecting the color of the beans while they are heated. Optionally air is vigorously blown through the roasting chamber a few times during the heating phase to swirl and rotate the heated coffee beans. At the end of the heating phase, the beans are rotated and swirled, by vigorously blowing air through the roasting chamber thereby fast cooling is provided and chaff is removed off the roasted beans. The level in
which the coffee beans are roasted is determined according to the disclosed method by determining the length of the heating time. For this purpose the user is assisted by inspecting and monitoring the color of the heated beans.

In US Patent 6214397 a system including a device for roasting coffee beans and a cooling tray for cooling the beans after being heated is disclosed. The disclosed device is installable within a general purpose home oven. The device has a base frame having a shaft onto which a cylindrical roasting chamber and a rotating mechanism are installed. The camber’s sidewall is circumferentially perforated providing for the heat generated by the oven to get into the roasting chamber and for the chaff released from the roasted beans to be discarded off. A chaff collecting tray is disposed beneath the roasting chamber for receiving the expelled chaff. The rotating mechanism, which is operated by means of a wound spring and has an escapement gear, such as the gear of a mechanical watch, provides for rotating the roasting chamber at a desired rate. The length in time in which the rotational motion of the roasting chamber continues is determined by the level of winding of the spring prior to the activation of the rotating mechanism. Baffles disposed on the inner surface of the roasting chamber provides for turning over the beans while the roasting chamber rotates.

In US patent 6497175 a different roasting device insertable into a home oven is disclosed. This device has a roasting tube made of mesh or perforated metal which is rotated by means of the integral rotating means of the home oven.

Selecting a proper heating time, heating at a desired initial temperature and according to a desired heating profile, as well as the fast thermal cooling of the heated coffee beans, are key factors in determining the quality of roasted coffee. These features and limitations, among others, are deeply discussed in the literature. Exemplary are: Gerhard A. Jensen, "Coffee Roasting Magic – Art – Science, 1st Edition Corporate Media GmbH, Munich 2006; Andrea Illy and Rinantonio Viani, Espresso Coffee, The Science of Quality, 2nd Ed. Illycaffe s.p.a. 2005, and Keneth Davis, Home Coffee Roasting – Romance and Revival, 2nd Ed. Kenneth Davis 2003, all of which stress the
importance of fast cooling and properly selecting the heating time by inspecting the color of the heated beans.

A major drawback associated with both last described systems is that the surrounding temperature of the coffee beans at the beginning of the heating phase is typically lower than required, since the user loads the beans into the roasting chambers, outside of the oven, while they are still at room temperature. This is due to the fact that it is quite difficult to fill in the beans while the device is installed within the hot oven and the roasting chamber is already heated prior to such filling. Thus, the relatively high thermal mass of the roasting device may significantly impact and damage the heating profile, which is the coffee beans’ temperature as a function of time within a roasting chamber that, in these cases, has not been preheated.

In addition to a lowered initial temperature, a user of such systems cannot inspect the color of the heated beans. Therefore ending the heating cycle cannot be fine tuned accordingly.

Cooling-wise, releasing the roasting chambers, with the hot beans, off the base frame is somewhat difficult due to the high temperatures and therefore might be delayed, resulting in lowered roast quality. Further, due to the high thermal mass and the enclosed nature of the roasting chambers of both devices, the heated beans have to be dispensed off the roasting chambers, and be evenly spread for fast and efficient cooling.

An integral roasting system such as the roasting system disclosed in US patent 6942887 provides for easy determination and fine tuning of the heating time by utilizing visual features of the roasted coffee beans. Such fine tuning provides for improvement of the quality of the roasted coffee. Furthermore, the fast cooling of the roasted beans provides for an enhanced quality as well. However, such system is more complex and therefore more expensive, and prone to malfunctions, compared to a device incorporable into common home oven appliances.
Therefore, any coffee roasting device insertable into a common home oven, providing for a desired heating profile, utilizing the visual features of the roasting beans, and providing for an enhanced cooling rate at the end of the heating phase is beneficial.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is an isometric view of a home coffee roaster according to a preferred embodiment of the present invention;

Fig. 2 is an isometric view of a roasting pan of a home roasting roaster according to another preferred embodiment of the present invention;

Fig. 3 is an isometric view of the home coffee roaster shown in Fig. 1 from which its roasting pan and rotator have been removed off;

Fig. 4 is an isometric view of a rotator of a home coffee roaster its roasting pan is shown in Fig. 2;

Fig. 5 is a scheme of a rotating mechanism of a home coffee roaster of the present invention;
DETAILED DESCRIPTION OF THE PRESENT INVENTION

In accordance with the present invention a home coffee roaster (HCR), which is insertable into a common, or a microwave based, home oven, is provided. The main components of a HCR of the invention are: an open roasting pan, a rotator, a chaff collecting pan that is mounted beneath the roasting pan, and a roaster base. Embodiments in which the chaff collecting pan serves also as a roaster base onto which the roasting pan and the rotator are mounted are in accordance with the present invention. The dimensions of the HCR of the invention are such selected that they can be conveniently placed at one shelf of a common home oven for the purpose of coffee roasting, while the other shelf, or shelves, can be concomitantly used for baking or warming a foodstuff to be flavored with the aroma of the roasting coffee.

Reference is now made to Figs 1 – 5. In Fig. 1 an isometric view of HCR 1, which is in accordance with a preferred embodiment of the present invention, is shown. Roasting pan 2 has a perforated base on which rotator 3 is mounted. The perforations are such sized that the beans to be roasted cannot pass through. However the perforations provide for expelling chaff off the roasting pan. Alternatively a net of a suitable mesh size may substitute the perforated base of the roasting pan. Such bases including a net are also referred hereinafter as perforated bases. Chaff collecting pan 4 interleaves between roasting pan 2 and roaster base 5. Rotating mechanism, not shown, installed within roaster base 5 provides for rotating rotator body 6 and its arms, such as arm 7, for evenly spreading and swirling the roasting beans. Aperture, not shown, centrally disposed at the perorated base provides a shaft extending off roaster base 5 for being connected to rotator body 6, which is placed above the perforated base. Rotatable knob 8 provides for charging the actuator of the rotating mechanism of the rotator. Cogged wheel gear provides for increasing the torque to be exerted by the user to the level required for charging the actuator. Charging is accomplished by rotating it in a predefined direction that is preferably indicated across the face of knob 8. Optional display 9 provides for displaying the temperature of the air adjacent to the coffee deans contained within the roasting pan by means of an optional thermometer housed in roaster
base 5. An optional shaft encoder, not shown, having a display disposed on the sidewall of roaster base 5 provides for displaying the number of complete turns and/or the length in time in which the rotator will rotate following the activation of the rotator. The dimensions of roasting pan 2 are such selected that it may contain up to 500 and preferably 250 - 300 grams of coffee beans while roasting. The topless pan allows a user to visually inspect the color of the beans while they are roasted by looking through the oven’s window.

In Fig. 2 roasting pan 10 which is in accordance with another preferred embodiment of the present invention is shown. Aperture 12 centrally disposed at the perforated base of roasting pan 10 is fitted for passing through the shaft around its axis the rotator rotates, as is further described below. Handles 14 provide a user with means for holding the roasting pan by itself and/or the assembled coffee roaster as one unit. Optionally a locking handle, not shown, provides for rigidly locking the roasting pan to the shaft, around which the rotator rotates. Roasting pans of HCRs of the invention are typically made of thin stainless steel or aluminum. It is important according to the present invention that their thermal masses are maintained as low as possible, such that both heating the beans to the selected roasting temperature and cooling them at the end of the process can be achieved at a relatively high rate respectively.

In Fig. 3 a HCR as shown in Fig. 1, is shown after its roasting pan and rotator have been removed off. The width of step 20 disposed at the sidewall of chaff collecting pan 22 provides spacing fitted to the base of the roasting pan. Shaft 24 upwardly extending through a fitted aperture disposed at the base of chaff collecting pan 22 provides for rotating the rotator which is installed within the roasting pan. Keying means 26, which is fitted to a respective recess disposed at the bottom of the rotator body, provides for rotatably locking shaft 24 to the rotator body. Snapping device provides for releasably attaching the rotator housed within the roasting pan to shaft 24, thereby releasably locking the roasting pan to the shaft. Such attaching provides for quick release of the roasting pan off the shaft for its removal off the oven at the end of the heating phase.
Rotators of HCRs of the invention are either provided with integral rotating mechanism such as rotator 30, shown in Fig. 4, or are rotated by means of an independent rotating mechanism, such as a mechanism housed for example in the roaster base. Rotator body 32 is releasably attached to shaft 34, which is rotatably fixed to the roaster base. Attaching is accomplished by means of snapping device activated by locking handle 38. Arms 36 circumferentially attached to rotator body 32 provide for swirling and evenly spreading the beans thereby a homogeneous heating of the beans is effected. The apertures disposed across the arms' bodies provide for reducing their masses as well as the value of the moment of inertia of rotator 30 relative to the axis of shaft 34. Locking handle 38 is movable between two positions providing for rigidly securing the rotating mechanism of rotator 30, not shown, to shaft 34 and/or releasing rotator 30 for its removal off the shaft. A cylindrical passageway is axially disposed within rotator body 32, not shown, whose apertures are centrally disposed at top face 39 and the opposing face of rotator body 32. this passageway provides for a shaft to be inserted.

In Fig. 5 an exemplary rotating mechanism of a rotator of a HCR of the present invention is schematically shown. Spring operated actuator 40, such as common hydraulic cylinder, consists of cylinder 42 in which piston 43 is slidingly and axially movable reciprocally in both directions. Orifice 45 connects between the lumen of cylinder 42 confined between piston 43 and wall 44, which is the first lumen, and the lumen of receptacle 46, which is a second lumen. The volume of the second lumen is changeable. Such receptacle having a changeable volume can be for example the lumen of cylinder 42 disposed at the side of piston 43 opposing the side in which the first lumen is disposed. Spring 48 presses against piston 43, which in turn pressurizes fluid 50 to be ejected off cylinder 42 through orifice 45 and delivered into receptacle 46. For operating Actuator 40 has to be charged prior to its being activated. For charging, spring 48 it has to be stressed at a predefined level concomitantly with moving piston 43 away from orifice 45. Fluid 50, which is pressurized out of receptacle 46, such as by the motion of piston 43 away from orifice 45, is drawn into cylinder 42. A safety catch, not sown, is set on to lock the stressed spring
still. By loosing the safety catch off, spring 46 moves back to its normal strained position concomitantly with ejecting fluid 50 off the first lumen into the second lumen. The rate in which such motion takes place is determined by the features of the spring, the dimensions of the orifice and the viscosity of the fluid employed. Obviously liquids, which are significantly less compressible than gases, are preferable to serve for slowing the rate of such motion. Any oil that is sustainable in temperatures up to at least 300°C can be used as fluid 50 according to the present invention. Preferable are those certified by the health authorities as food grade oils or at least as non toxic. Gas such air is also applicable as a fluid according to the present invention. In such a case the receptacle having a changeable volume is not required, however charging the actuator by stressing the spring is accomplished by means of a pump that pressurizes the air into the first lumen. Additional gear provides for concomitantly stretching the cables. A valve implements the safety catch described above to lock/release the motion of the spring back to its normal strain.

The rotating mechanism described herewith includes also cables 52, 52B, 52C and dual pulleys 54A, 54B to transform the linear motion of piston 43 into a rotational motion. One end of cable 52 is connected to piston 43, a segment of the cable is winded around the smaller wheel of pulley 54A such that its other end is connected to this wheel. Pulley 55 provides for changing the direction of cable 52 while retaining its being stretched. The ends of cable 52B are respectively connected to the larger wheel of pulley 54A and the smaller wheel of pulley 54B. Segments of cable 52B at both of its ends are winded around the respective wheels of pulleys 54A and 54B. Similarly the ends of cable 52C are respectively connected to pulleys 54B and 60, while segments of the cable are winded around these pulleys respectively. By releasing the stressed spring off, cable 52 is pulled to move along the direction indicated by arrow 62, which causes rotational motion of pulleys 54A, 54B and 60 in the direction indicated by arrow 64. Preferably, axial bearing, not shown, are employed as known, providing for reducing the forces hindering the rotational motion of the rotator. The axes of pulleys 55, 54A and 54B as well as
actuator 40 are rigidly attached to a mounting frame, not shown. In a case of rotating mechanism that is integral to the rotator of a HCR according to a preferred embodiment of the present invention, this mounting frame is connected to the top cover of the rotator body, which is the segment of the rotator that is rigidly attached to the shaft extending off the roaster base of the HCR. Therefore these members do not rotate about this shaft while being moved. However pulley 60, geometrically shaped as a cylindrical ring, is attached to the bottom of the rotator body circumferential to the aperture through which the shaft extending off the roaster base is introduced. In a case in which the rotating mechanism is housed within the roaster base the frame onto which the axes of the pulleys are attached is firmly attached to the roaster base whereas pulley 60 is firmly attached circumferential to the surface of the shaft. One end of the shaft is rotatably connected to the roaster base body by means of an axial bearing.

The rotational rate of pulley 54A is linear with the translational velocity of piston 43 and the length of radius 66A. By suitably selecting the lengths of radii 66A, 68A, 66B, 68B and the radius of pulley 60 the number of turns of the rotator body to be completed while piston 43 moves all the way towards its stopping end can be determined. The rotator of a HCR of the invention is typically made of stainless steel and/or aluminum. The arms of the rotator are especially made thin, the rotating mechanism is mostly made of stainless steel and is therefore of light weight, thereby the mass of the entire rotator is substantially low, such that the moment of inertia of the rotator about the shaft of the HCR is as low as possible. Such rotating mechanism typically provides for swirling coffee beans contained within the roasting pan at a rotational speed of at least one, but preferably two, RPM for about 20 to 25 minutes.

In addition to the pneumatic and/or hydraulic based actuators described above, other rotating mechanisms, or actuators, such as of mechanical watches, or electrically operated by means of electric solenoids, motors, or electric step motors, can be employed according to the present invention. Furthermore, the safety catch or the valve providing for activating the rotational motion of the rotator can be locked/released by means of a remote
control unit electrically operated, which is wired or wireless connected to the actuator of the rotator, as known.

A HCR according to another preferred embodiment of the present invention is especially suited to be incorporated with a microwave based home oven. The rotator of this HCR is rotated by means of the rotational actuator integral to the oven. Namely, its rotator is not actuated by any of the rotating mechanisms described above. Its roasting pan is the same as any of the roasting pans described above. Its chaff collecting pan has a circular aperture disposed at its base and is similarly fitted to house the base of the roasting pan. However an additional base frame is provided for holding the roasting pan mounted onto the chaff collecting pan above the bottom of the oven. Its rotator having two or more arms laterally extending off a long shaft is mounted onto the juxtaposed roasting pan and chaff collecting pan, such that the shaft passes through the apertures of both pans' bases and the arms are placed within the roasting pan. Connecting bracket provides for attaching and rotatably locking the free end of the shaft to the axis of the rotating actuator of the microwave oven. A snap mechanism provides for such attaching. Namely the entire HCR can be removed off the oven by pulling it off the axis of the rotating actuator. An auxiliary thermometer that can be affixed to one of the arms provide for measuring the temperature of the beans. The color of the heated beans can be visually inspected by looking through the window of the microwave oven while the beans are heated. The components of this HCR are made of glass or ceramics such as utilized for manufacturing containers for heating foodstuff by irradiating with microwaves.

For coffee roasting by means of a HCR insrtable into a common home oven, the HCR is first assembled, its rotating mechanism is charged on and the HCR is placed without the beans within the home oven to be pre-heated to a predefined temperature. In a case of a HCR insertable into a microwave based oven, the HCR is placed within the oven by first mounting the shaft to the rotating actuator of the oven and placing the roasting pan on top of the chaff collecting pan on top of the mounting frame which is placed on the bottom of the oven. At this stage a predefined quantity of coffee is filled in the roasting
pan the, rotator is activated by releasing the safety catch and the door of the oven is closed. In a case of microwave based oven the irradiating power is set to a predefined level and the oven is switched on. The coffee beans are heated, swirled and evenly spread by means of the rotating rotator. The beans' temperature and colors are monitored by the user who switches the oven off after a predefined time and/or according to the level of the inspected color. Monitoring the color of the heated beans, which are continuously swirled by the rotator, is visually accomplished by looking through the window of the oven. At this stage the only the roasting pan, with the hot beans, is removed off the chaff collecting pan following its being released off the shaft and is placed under a fine water spray, and/or exposed to blown air, or simply allowed to cool off near the window.
CLAIMS

1. A home coffee roaster (HCR) insertable into a home oven, said HCR comprising
   • an open roasting pan having a perforated base adapted to contain a predefined quantity of beans of coffee;
   • a rotator installable within said roasting pan having at least one laterally extending arm for swirling said coffee beans;
   • a shaft having an axis around which said at least one arm is rotatable, and

wherein said roasting pan is releasably attached to said shaft.

2. A HCR as in claim 1, wherein said rotator is releasably attached to said shaft.

3. A HCR as in claim 1, wherein said at least one laterally extending arm firmly attached to said shaft.

4. A HCR as in claim 1, further comprising a chaff collecting pan installable beneath said roasting pan.

5. A HCR as in claim 4, wherein said shaft is firmly attached to the base of said chaff collecting pan.
6. A HCR as in claim 4, wherein an aperture centrally disposed at the base of said chaff collecting pan fitted for passing a segment of said shaft through.

7. A HCR as in claim 1, further comprising a rotating mechanism activated by means of an actuator selected from a group of actuators consisting of pneumatic actuators, hydraulic actuators, electric solenoids, electric motors, electric step motors, rotating mechanisms of mechanical watches and any combination thereof.

8. A HCR as in claim 7, further comprising a roaster base from which said shaft is extending.

9. A HCR as in claim 8, wherein said rotating mechanism housed within said roaster base.

10. A HCR as in claim 1, wherein said oven is a microwave based oven, and wherein said shaft is connectable to a rotating actuator integral to said oven.